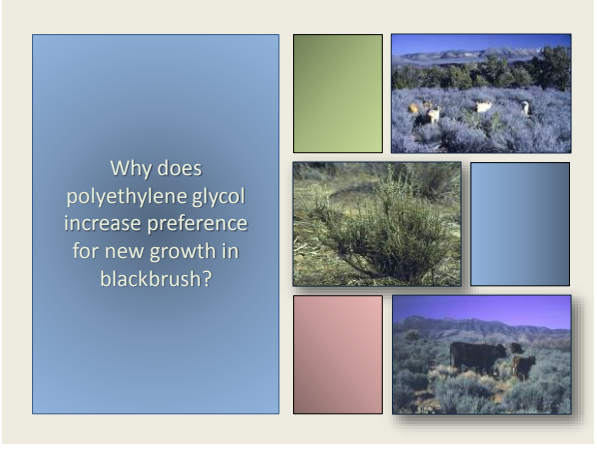
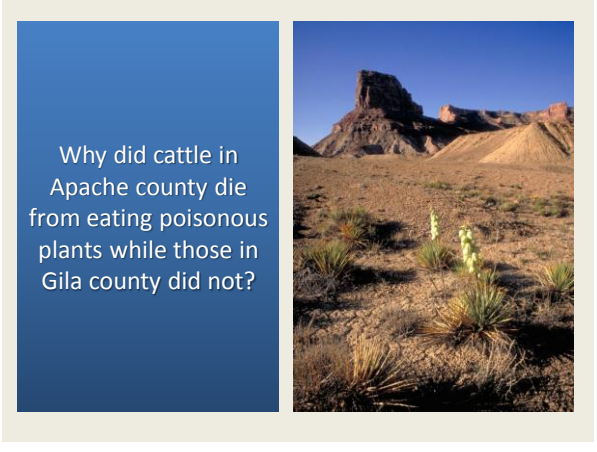
Flavor-Feedback Associations

Wisdom of the Body
Flavor-Feedback Associations



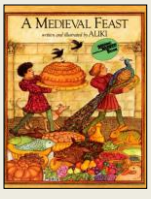


Flavor-Feedback Associations

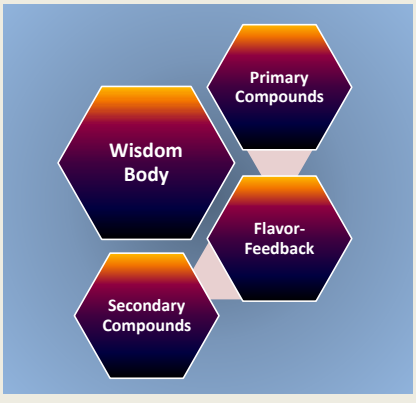
When toxicosis occurs after eating black mice, hawks avoid black and white mice, even though they have an excellent visual cue. Why?

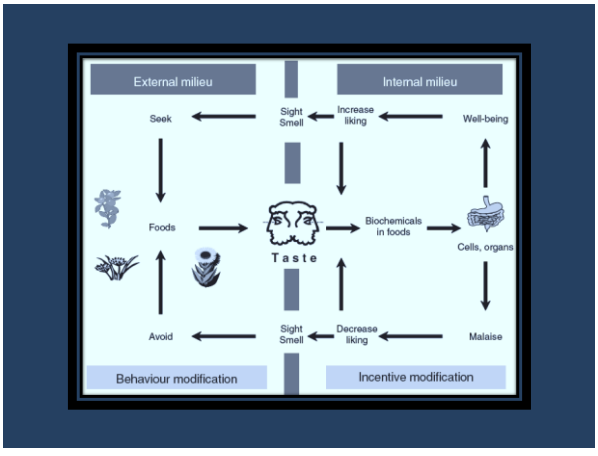
Why do robins eat grapes sprayed with methyl anthranilate?

What is Palatability?



Palatability is more than a matter of taste.





Flavor-Feedback Associations

Nutrients Increase Palatability

Conditioning	Group 1	Group 2
• Odd days • Even days	apple → water maple → nutrient	maple → water apple → nutrient

Testing | Choice between apple and maple

[redacted]

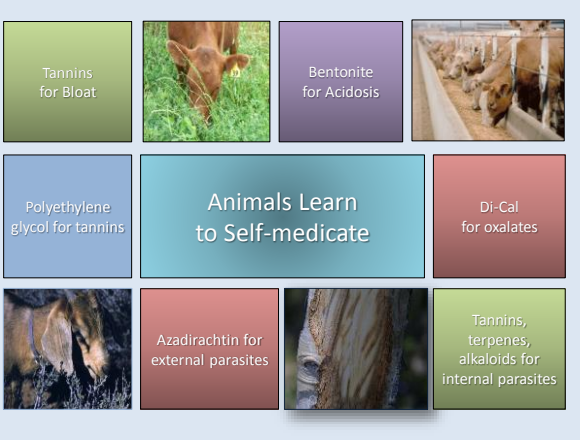
Postingestive Feedback

Primary Compounds
- Energy (cellulose, starch, glucose, VFAs)
- Protein (NPN, rumen degradable, bypass)
- Minerals (Na, P, Ca, Se, S)
- Vitamins (E)

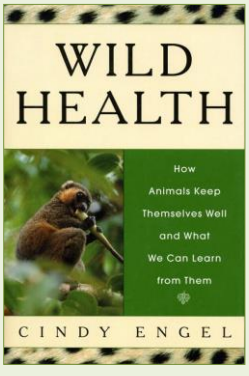
Intake
Preference
Wanting, Liking

deficit adequate excess

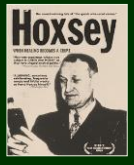
Secondary Compounds
- Phenolics
- Alkaloids
- Terpenes
- Medicines (bloat, acidosis, parasites, antioxidants, boost immune function)



Nature's Pharmacy
Food, Medicine, Self Medication
Information for Survival
Microscopic Foes
Gaping Wounds, Broken Bones
Mites, Bites, Itches
Reluctant Hosts, Unwelcomed Guests
Getting High
Psychological Ills
Family Planning
Facing the Inevitable

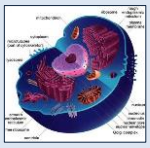


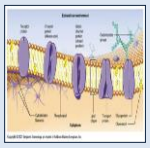
Do cells have memories for medicines?

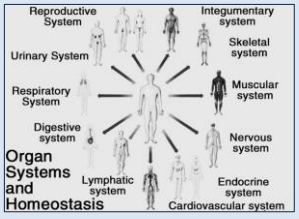


Flavor-Feedback Associations

Flavor-feedback interactions involve phytochemicals interacting with cells and organ systems in a dynamic network of communication that unites cells and organ systems with environments.





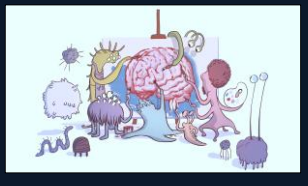


Consider the phytochemical complexity of a meal of sautéed spinach with ginger, whole grain ravioli shells stuffed with butternut squash and spices, topped with a walnut tomato sauce or of 10 to 50 species of grasses, forbs, and shrubs for herbivores.

Phytochemicals interact with one another and with cells and organ systems in extremely complex ways we will never fully understand.

These relationships, mediated by nerves, neurotransmitters, peptides, and hormones, are the basis for the nutritional wisdom of the body manifest through the ability to meet needs for energy, protein, amino acids, various minerals, and to self-medicate.

The gut can sense specific chemical entities, physicochemical properties of its contents, pathogenic organisms and their by-products including toxins.



In addition, a positive-feedback loop likely exists between the preferences of the host for a particular dietary regimen, the composition of the gut microbiota that depends on that regimen, and the preferences of the gut microbiota.

For ruminant nutritionists, this isn't news. They've understood the links between microbes and herbivores for 50 years.

Oxalates

Mimosine

A diet rich in secondary compounds stimulates diverse microbial populations that can degrade secondary compounds, thus enabling herbivores to eat plants they otherwise could not eat.

For human nutritionists, the microbiome is a hot topic.

Refined Carbohydrates Starch Digesters

Vegetables Fiber Digesters

Meat Gut Flora TMAO

What we eat feeds microbes.

Flavor-Feedback Associations

Skin and Gut Defenses

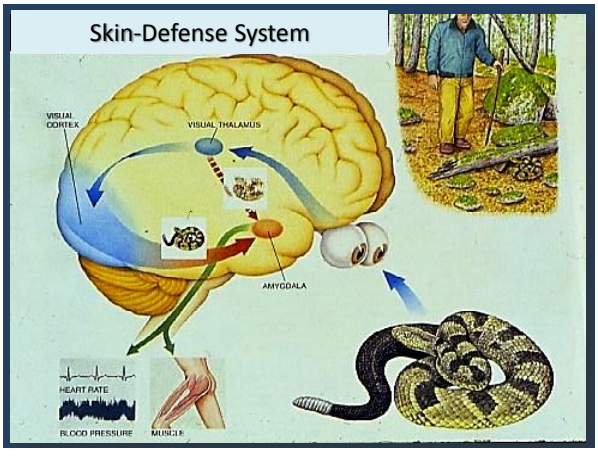
Skin & Gut Defense Systems

All organisms have evolved coping mechanisms for detecting nutrients and protective mechanisms to keep from becoming nutrients.
John Garcia

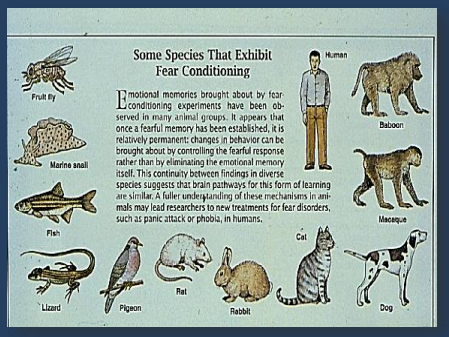
When toxicosis occurs after eating black mice, hawks avoid black and white mice, even though they have an excellent visual cue. Why?

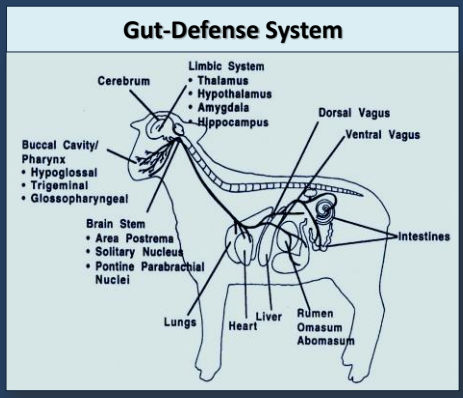
All cues are not associated readily with all consequences

	Gut	Skin
Taste	aversion	no aversion
Audio-visual	no aversion	learn defense
Smell	aversion	learn defense



Flavor-Feedback Associations





Two kinds of memory underlie skin and gut defenses

Explicit	Implicit
✓ cognitive	✓ non-cognitive
✓ hippocampus	✓ amygdala
✓ skin: snake	✓ skin: fear
✓ gut: food	✓ gut: nausea

Skin and gut defenses operate on different time

Skin: milliseconds to seconds
Gut: minutes to several hours

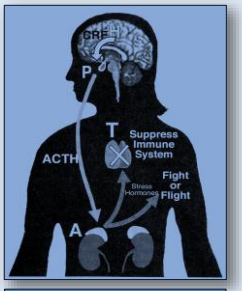
How does d-CON kill mice?

Mice may consume a lethal dose in one feeding with first dead mice appearing in 4 or 5 days after feeding begins.

Skin and Gut Defenses are Mutually Inhibitory

The mess boys of the U.S.S. Chase wore immaculate white jackets and served hot cakes, sausages, eggs and coffee with unusual zest and politeness. But the pre-invasion stomachs were preoccupied, and most of the noble effort was left on the plates. R. Capa

Flavor-Feedback Associations



Physiology of Stress

Stress, Immune Responses, and Animal Performance

Why do robins eat grapes sprayed with methyl anthranilate?

Flexibility is the Key

Skin
avoid hazards

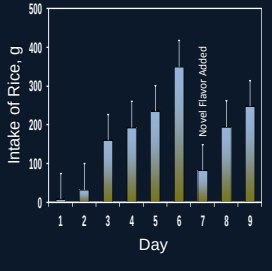
Gut
nutrients, toxins

What constitutes hazards and food varies from time-to-time and place-to-place

Familiar-Novel Dichotomy

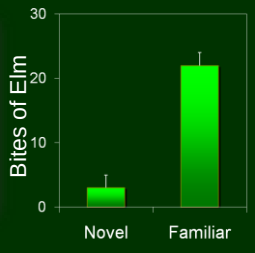
Why did cattle in Apache county die from eating poisonous plants while those in Gila county did not?

If nutritional state is adequate, familiarity breeds content, novelty breeds contempt, animals are neophobic.

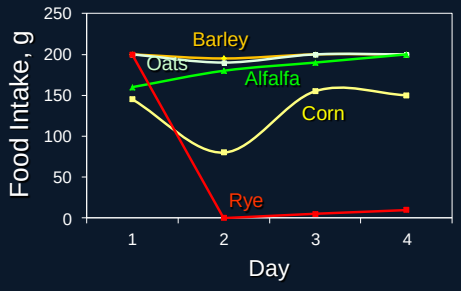


Flavor-Feedback Associations

Lambs sample familiar foods with novel flavors



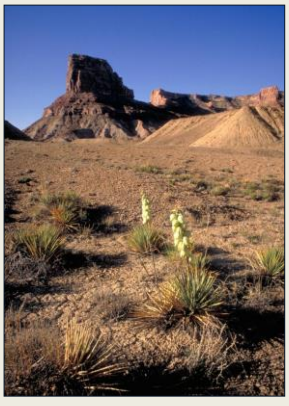
Familiar-Novel Dichotomy



Animals prefer familiar - toxic plants - to unfamiliar plants in unfamiliar environments

Facilitate the transition with familiar foods, de-stressing and placing…

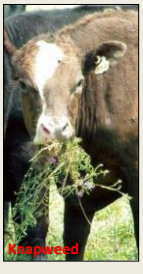
- Plant Chemistry
- Combinations of Plants
- Prefer Familiar to Novel Foods
- Stress of Unfamiliar Environment



Cattle can learn to be connoisseurs of "weeds"

Kathy Voth

Cattle as weed managers enhance biodiversity



Grazing management can change patterns of food and habitat selection.

Training livestock to be weed eaters…

Boom-Bust Grazing

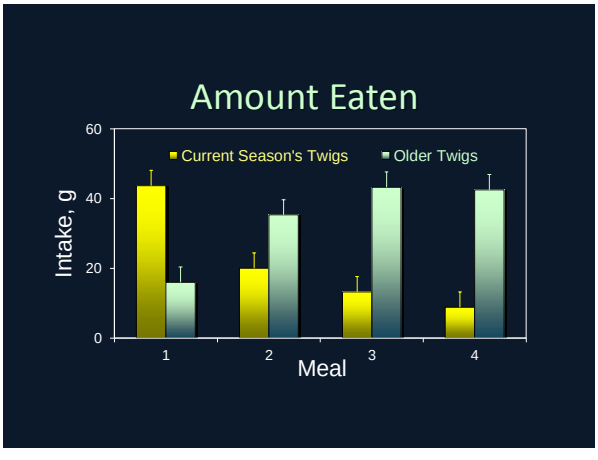
Short-Duration, Management-Intensive, and Mob-Grazing

Livestock can learn to "mix the best with the rest" rather than "eat the best and leave the rest"

Flavor-Feedback Associations

Prior Experience

Amount of Each Food Eaten



Flavor-Feedback Associations

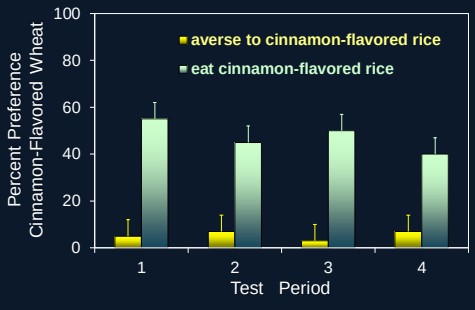
Why does polyethylene glycol increase preference for new growth in blackbrush?

Polyethylene glycol binds to tannins in new growth, alleviating their aversive effects in the body.

Cattle supplemented with polyethylene glycol eat more serecia.

Generalization

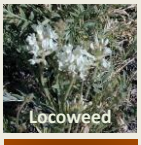
Generalization



Cattle can be trained with molasses to eat thistle, knapweed, leafy spurge, sagebrush…

Animals generalize from familiar to unfamiliar foods based on a familiar flavor.

By understanding palatability, people can reduce losses to poisonous plants.

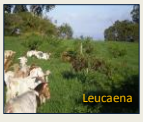


Target Food → LiCl → Aversion

Flavor-Feedback Associations

By understanding palatability, livestock can be trained to selectively forage and fertilize to reduce costs and enhance production

Target Food → LiCl → Aversion



Eating Unusual Foods

Why do animals eat unusual foods?

Alleviate deficiencies
- minerals: Na, P, Ca, Se, S
- vitamins: E

Why do goats eat woodrat houses?

Goats eat woodrat houses…

…to alleviate a protein deficiency.

Of 18 groups of goats during 3 winters, only 1 group learned to eat woodrat houses.

Flavor-Feedback Associations